When it is desired to start the engine **12** in a normal starting procedure, the clutch **90** is actuated so that power will be conveyed to the first output **94**. Compressed air from the ground source **34** or from the bleed air line **32** for the engine **14** if the engine **14** is operating is directed to the line **78** and applied via the first nozzle **72** to drive the turbine wheel **62**. As a consequence, rotation of the turbine wheel **62** will cause rotation of the output **94** with the result that the turbine of the engine **12** will be driven by reason of its connection to the AMAD **16**. The entire system will accelerate to the point where operation of the engine **12** becomes self-sustaining at which time, flow of compressed air to the nozzle **72** may be halted and the output shaft **94** disengaged from the transmission **84**.

In a typical emergency situation, electrical and/or hydraulic power will be unavailable from the pumps **20**, **22** or the integrated drive generators **24**. This in turn means that where the aircraft **10** is a single engine aircraft, the sole engine will be inoperative at that point. Similarly, if the aircraft **10** is a multiple engine aircraft, it will mean that all engines are inoperative.

In order to provide hydraulic and/or electrical power to complete the link between the controls and the control surfaces of the aircraft so as to enable the pilot to recover control of the aircraft, the stored energy system **36** is fired. In particular, fuel from the tank **38** and oxidant from the vessel **44** are directed to the combustor **40** and combusted therein. The hot gases of combustion will vaporize additional fuel admitted into the combustor **40** at the point **60** and the resulting hot gases will be directed via the second nozzle **74** against the turbine wheel **62** to drive the same and rapidly bring the same up to speed. At this time, the clutch **90** will be selectively engaged so that the second output **96** will provide rotational power to the power generator **102** to drive the same. Upon being driven, the power generator **102** will provide power to enable the controls and the control surfaces to be linked and the pilot to again acquire control over the aircraft. Preferably, the system is designed with minimum rotor inertia so that power will be available from the power generator **102** in about two seconds or less from the time the stored energy system **36** is fired.

Once control of the aircraft **10** has been regained, consumption of power being provided by the power generator **102** is minimized and the clutch **90** engaged so that the first output **94** is driven. This will, through the AMAD **16**, drive the turbine of the engine **12** and bring the same up to a speed whereat it may be started. For the type of system illustrated in FIG. **1**, once the engine **12** has been restarted, bleed air from the bleed air line **30** may then be directed to the ATSM **28** so as to allow initiation of the starting procedure for the engine **14**. However, it should be understood that if desired in a two engine aircraft, the ATSM **28** could be replaced with a turbine wheel, transmission and clutch assembly much like that illustrated in FIG. **2** and driven off the same or different stored energy system **36** as desired.

From the foregoing, it will be appreciated that the invention provide an on-board emergency main engine starting capability through the use of the stored energy system and without resorting to the use of an on-board auxillary power unit. In aeronautical applications, the resulting weight saving is considerable. In addition, the emergency power unit feature of the invention is utilized to allow the establishment of stable flight prior to any attempted restart of the main engine or engines, minimizing workload.

The invention is also susceptible to use in aircraft having electric motor driven hydraulic actuators in close proximity to the aircraft control surfaces. In such a case, initial electric power following a flame out of the main engine or engines could be provided to such electric motor driven hydraulic actuators from the aircraft battery system to provide stabilization of the various control surfaces. The generator employed in the invention could therefore be downsized to the point to provide for only recharging of the battery systems and provide a further reduction in inertia, physical volume and weight of the total system.

I claim:

1. An aircraft engine starting and power generating system for use with an airframe mounted accessory drive unit (AMAD) associated with a turbine engine comprising:

a rotary turbine wheel;

a clutch connected to said turbine wheel and having selectively operable first and second rotary outputs, one adapted to be connected as an input to an AMAD and the other connected as an input to a power generating apparatus;

a nozzle structure for said turbine wheel and adapted to direct compressed air from a source such as a bleed air outlet of a turbine engine or a ground based compressor system, or hot gases of combustion at said turbine wheel;

a combustor connected to said nozzle;

a fuel supply connected to said combustor to provide fuel thereto for combustion therein; and

a storage tank for containing an oxidant and connected to said combustor to provide oxidant thereto to support combustion of the fuel therein;,

whereby said turbine wheel may be driven by compressed air or by hot gases of combustion and said turbine wheel coupled to an AMAD by said clutch, to act as a conventional or emergency starter for a turbine engine associated therewith, or said turbine wheel may be driven by hot gases of combustion and said turbine wheel coupled to a power generating apparatus by said clutch to act as an emergency power unit.

2. The aircraft engine starting and power generating system of claim **1** wherein said clutch is connected to said turbine wheel by a planetary transmission.

3. The aircraft engine starting and power system of claim **1** wherein said clutch is a two-way clutch.

4. The aircraft engine starting and power generating system of claim **3** wherein said clutch is a dump and fill fluid coupling.

5. The aircraft engine starting and power generating system of claim **1** wherein said power generating apparatus is an electrical generator.

6. The aircraft engine starting and power generating system of claim **1** wherein said power generating apparatus is a hydraulic pump.

7. The aircraft engine starting and power generating system of claim **1** wherein said nozzle structure is a dual nozzle structure having a first nozzle for directing compressed air and a second nozzle for directing gases of combustion.

8. The aircraft engine starting and power generating system of claim **7** wherein said turbine wheel is a radial inflow turbine wheel and said first and second nozzles